The Celtic Sea Trout Project 2009-2013

North Wales Fisheries Conference

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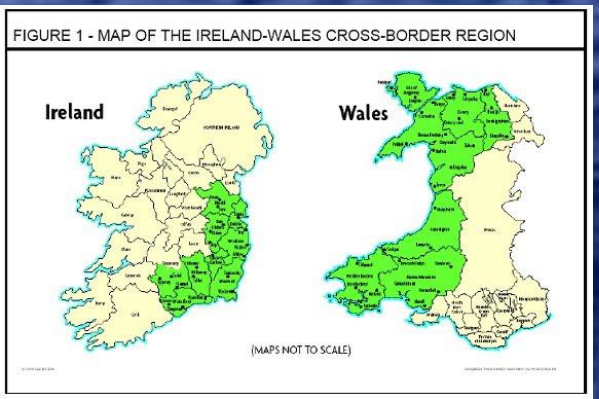
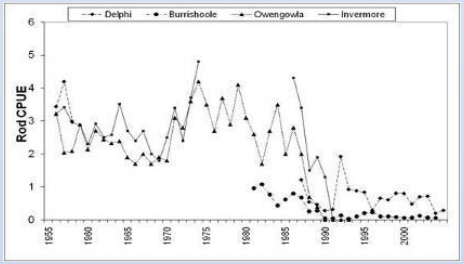
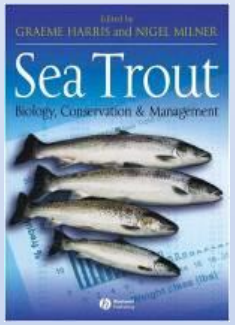


Introduction to the CSTP

BACKGROUND

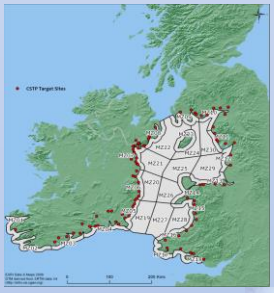
- Historical neglect *vs* salmon
- Stock collapse – focused minds & funded R&D
- 2004 Cardiff Symposium review ► Gaps
- Interreg IVA funded cross-border CSTP





AIMS

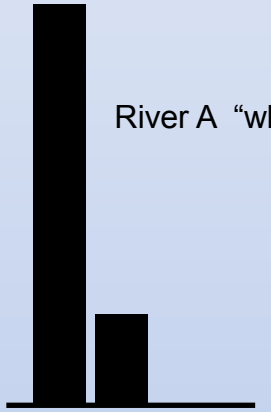
- Marine distribution, stock identity & ecology
- Life history variation, description & causes
- Long term collaboration + awareness



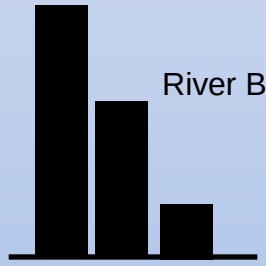
APPLICATIONS

- Stock assessment, mixed stocks fisheries
- Responses to pressures.. past, present and future
- Managing risks from marine developments
- Bio-indicator role across FW-transitional-coastal habitats

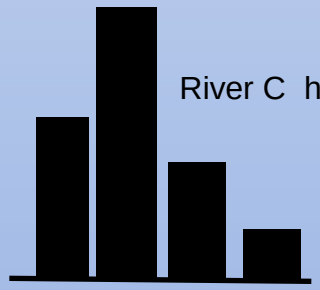
A basic question… why do sea trout stocks vary regionally and over time?



River A “whitling” dominated

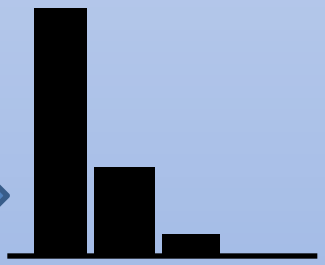


River B average



River C high average size

Changes over time



Reduction of older/larger fish

- Life history theory
- Environmental variation
- Other pressures

Partial migration and anadromy : “To Sea or Not to Sea?”

4yr old “brown trout” (400eggs)

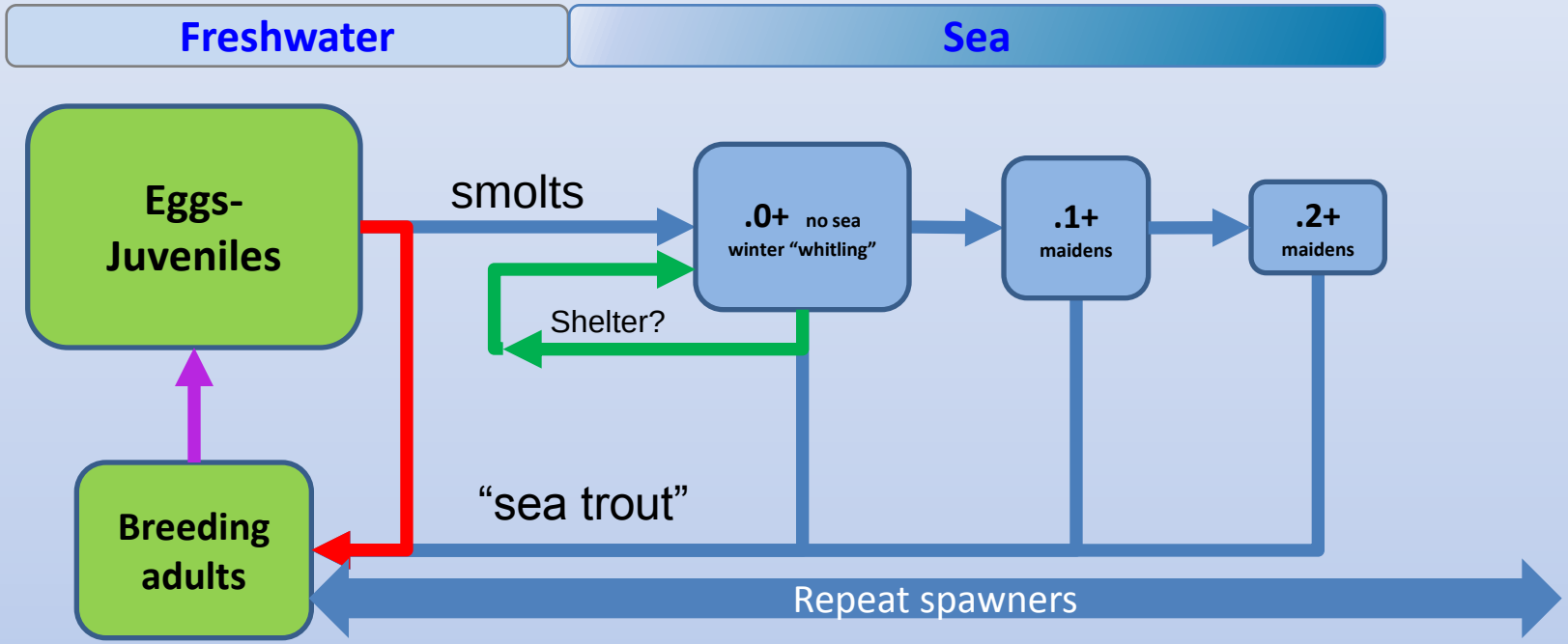
Smolting/Migration

Benefits (eggs)
vs
Risks (death)

4yr old “sea trout” (6,000eggs)

Photo: Ian Davidson, DSAP

Partial migration in trout



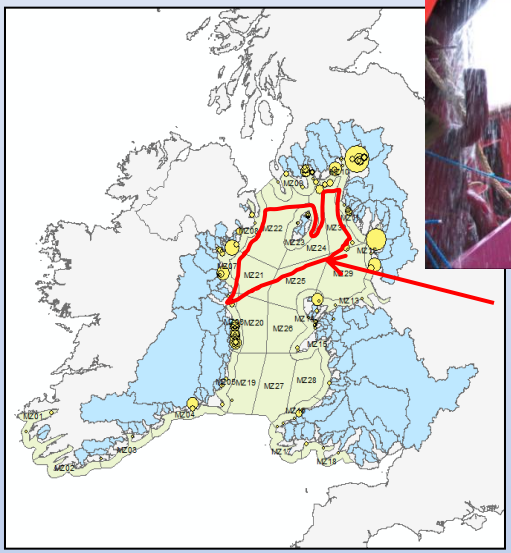
Performance at sea affects age structures of sea trout stocks and fisheries

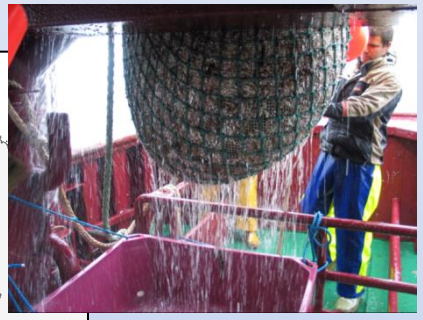
Question 1: why return from sea? (Ans: spawning, complete the life cycle)
Question 2: when to return? (Ans: maturation…survival, growth??? …traits related to marine habitat)
Question 3: what determine proportions of sea ages? (Ans: ???LH tactics that maximise potential eggs)

Sampling (2009-2012)

Marine (post-smolts and adults):

- Beaches, estuaries, coastal, offshore
- Trawl, seine, rods
- 1,367 scale sets

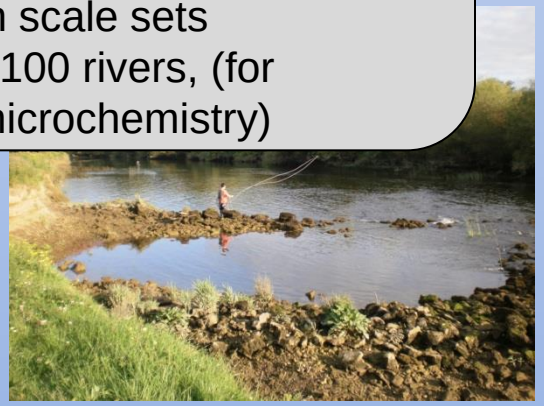


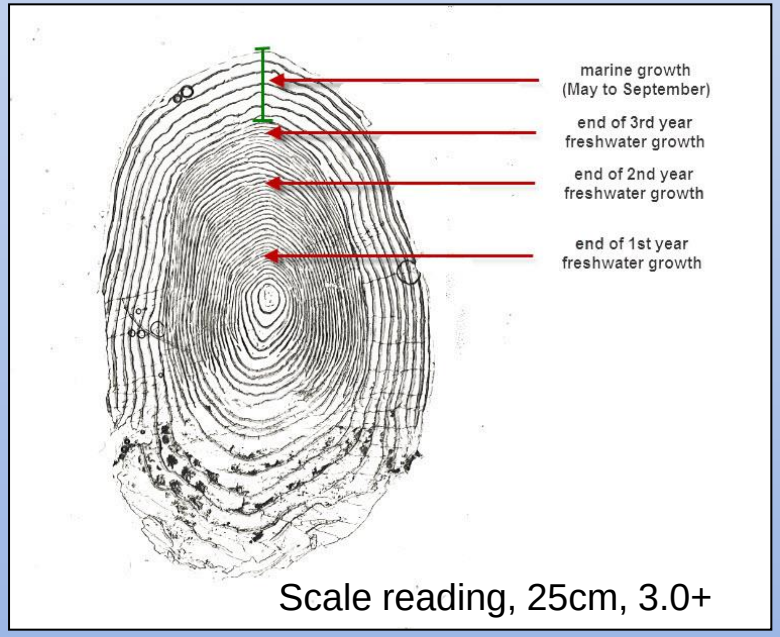


Surface trawling

Rivers (juveniles and adults):

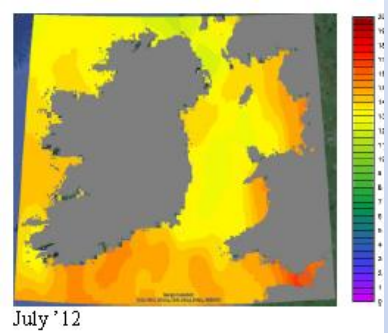
- Angler samples
- Rod catch statistics
- Traps
- 5,538 adult fish scale sets
- Electro-fishing 100 rivers, (for genetics and microchemistry)

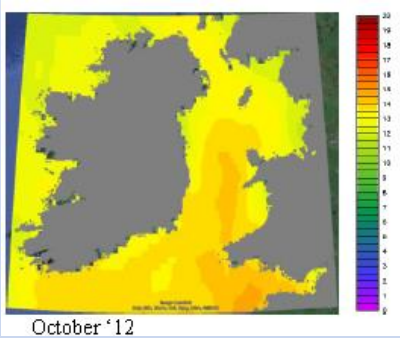




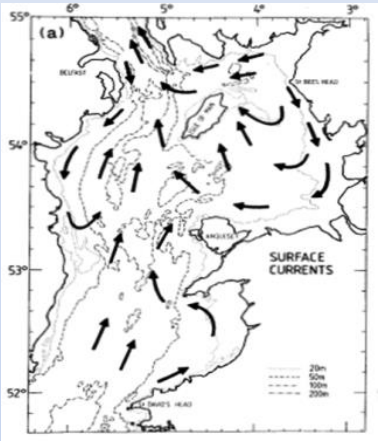
Scale reading, 25cm, 3.0+

Marine habitats are highly structured

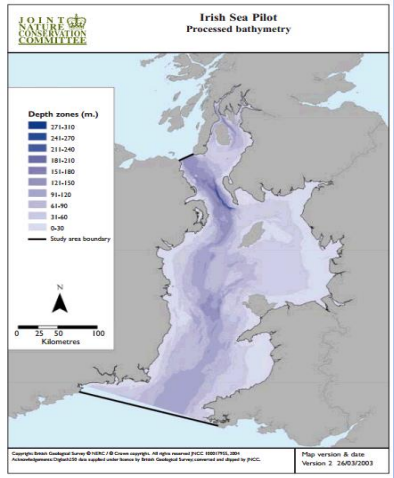




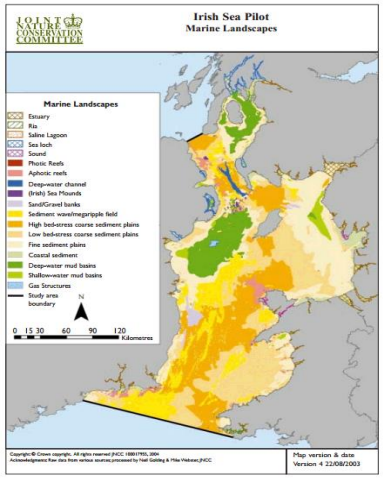
Sea temperature (NB mean and range greater in east sea board)



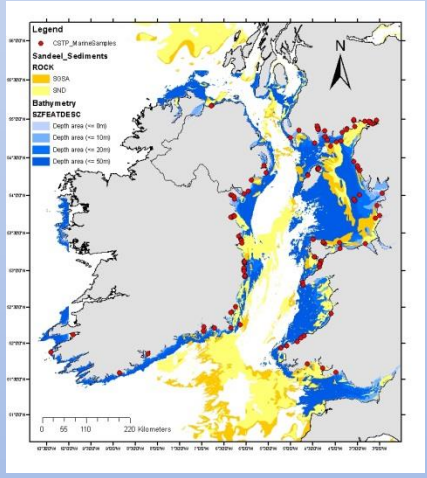
Currents



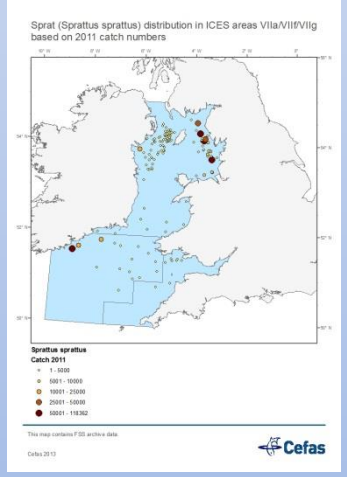
Bathymetry



Seascape



Prey (sand eel) habitat

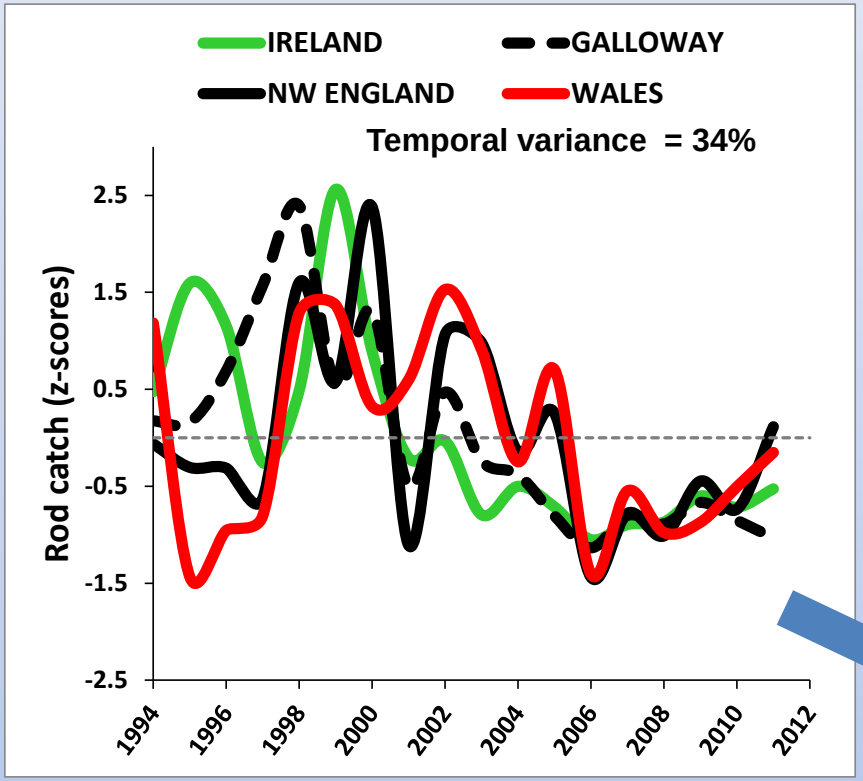


Prey abundance

Results

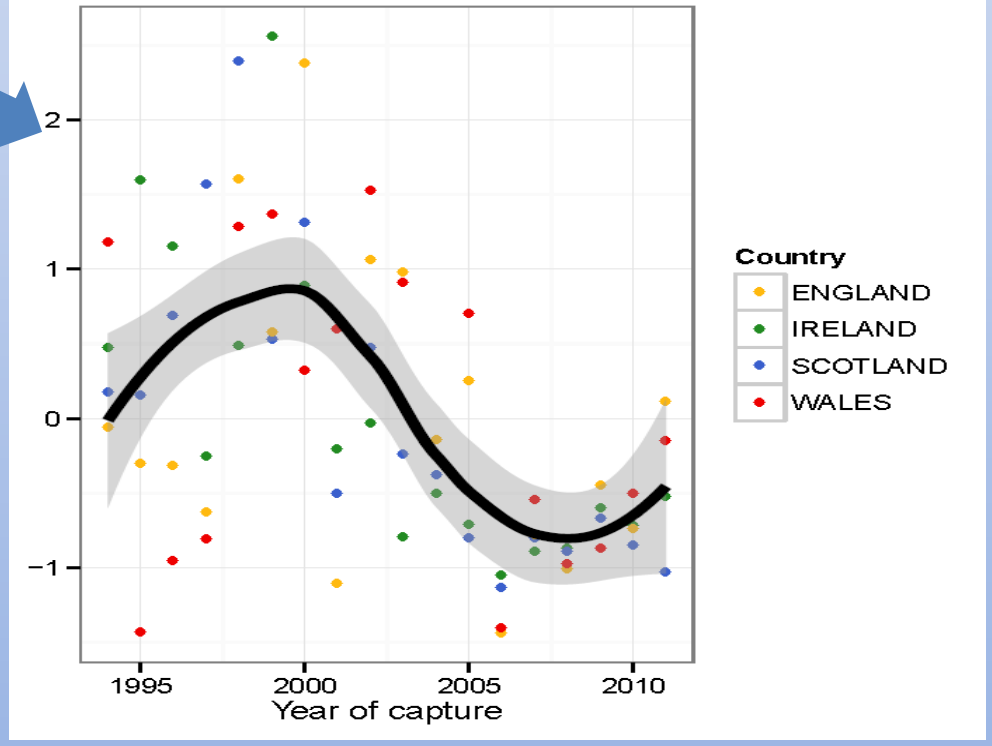
- **Trends in abundance and stock composition**
- **Regional variation in life histories**
- **Feeding**
- **Movements and exchange**

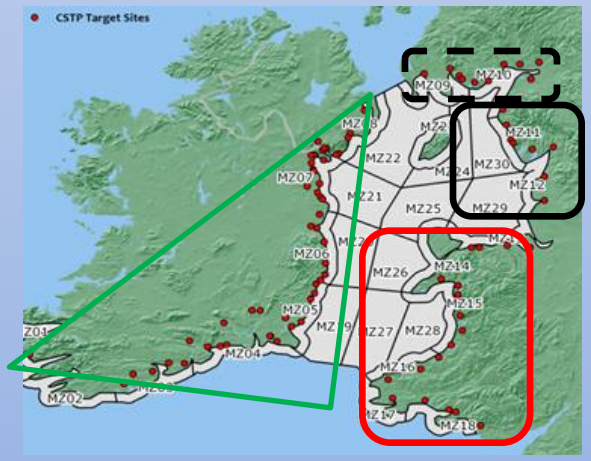
Synchrony in catch trends, 1994-2011



- Mean catch for each country/region
- Strong temporal coherence (Vt = 34%)
- Common factors acting on stock?
- Effort analysis in E&W showed very low coherence, but high in catch and cpld

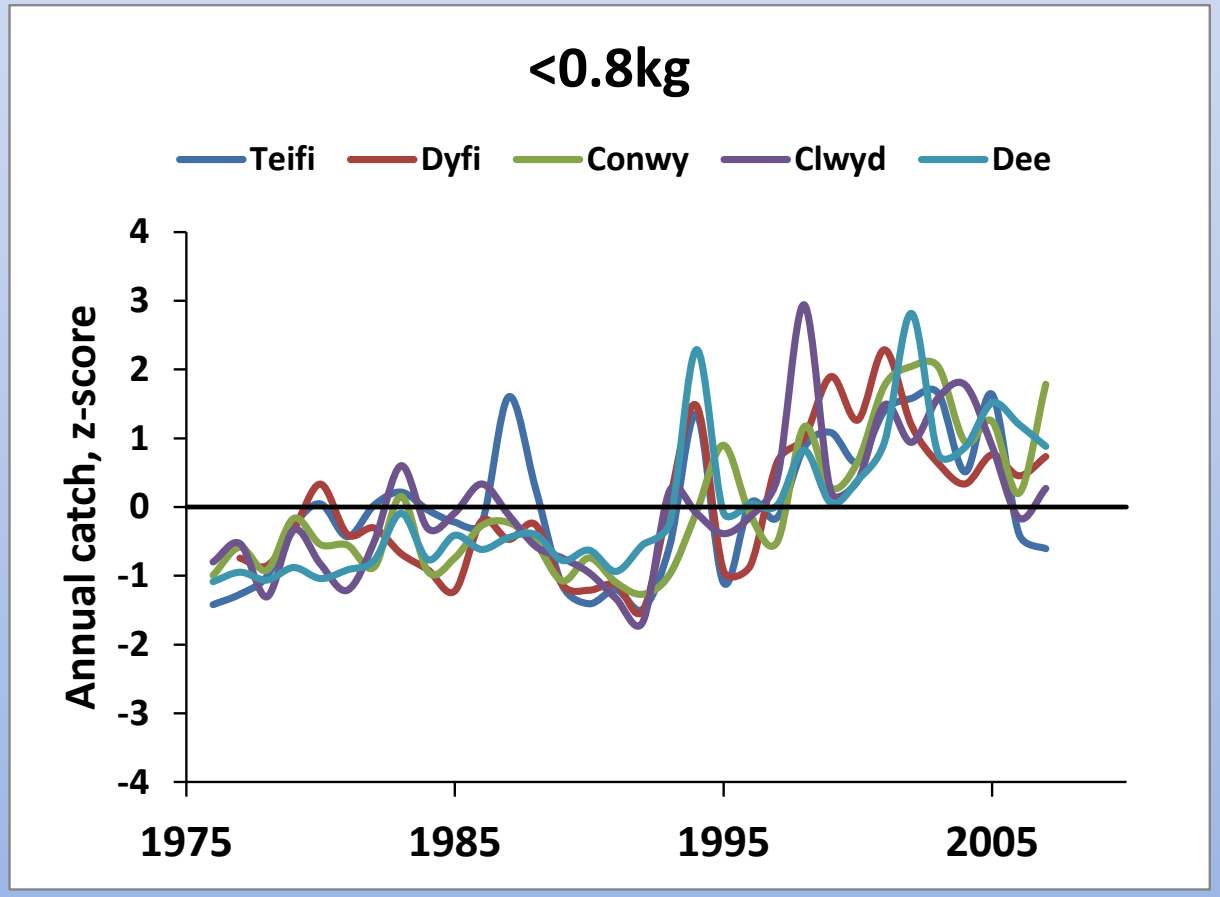
Overall smoothed, 95% CIs



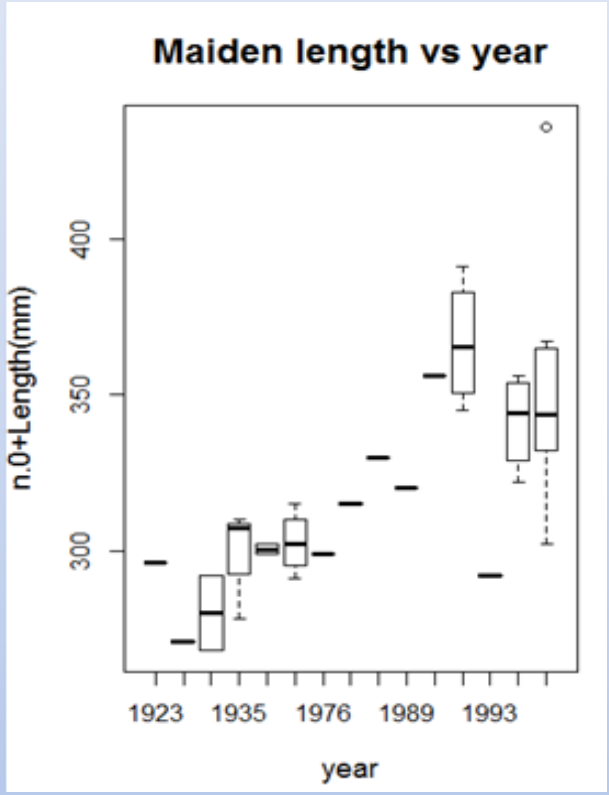


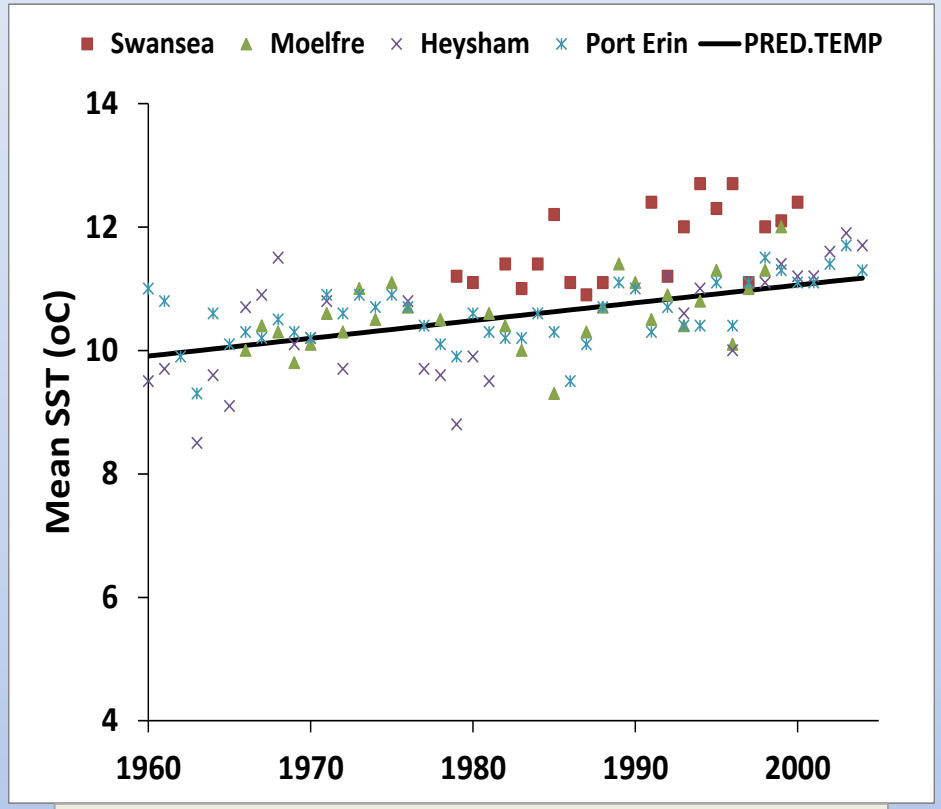
Long term changes in catches and size composition in 5 Welsh rivers, 1976-2007

- 0.8kg = “whitling” (n.0+)
- Increasing abundance and % of whitling
- Reduction in N and % of larger fish in some rivers
- Evidence of life history change
- Time of 1st maturation, can’t exclude reduction in survival



Temporal variation in marine growth

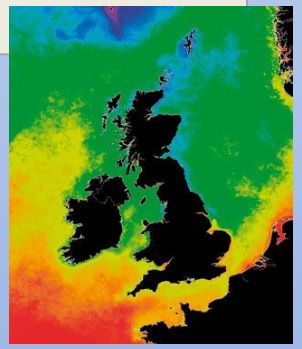




Historical data (eastern sea board)

- Size of whitling increased 1923-2000
- Mixed year and latitude effects

- Sea temperature increase
- Part of climate change



Temp data: MAFF/Cefas

Results

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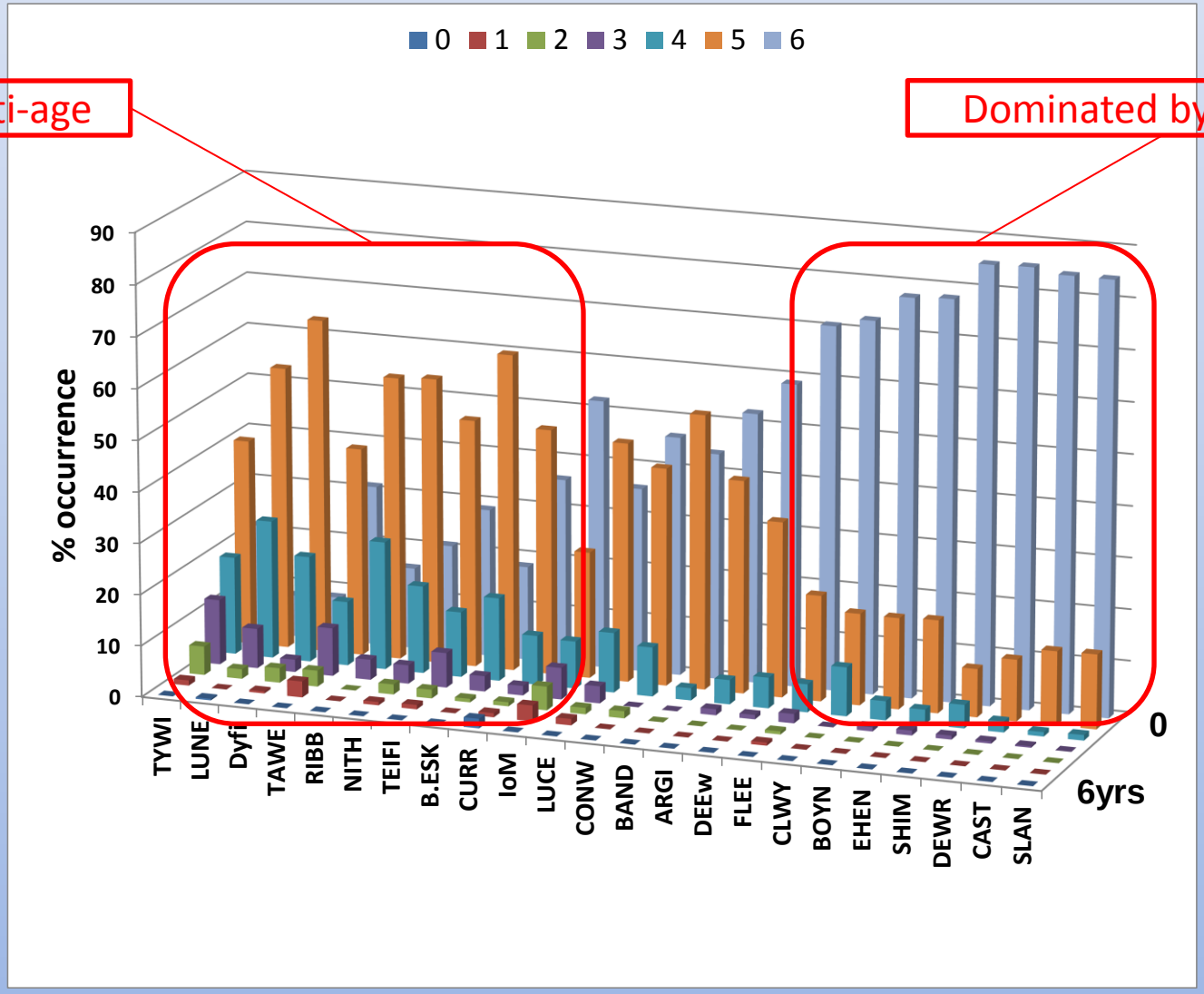
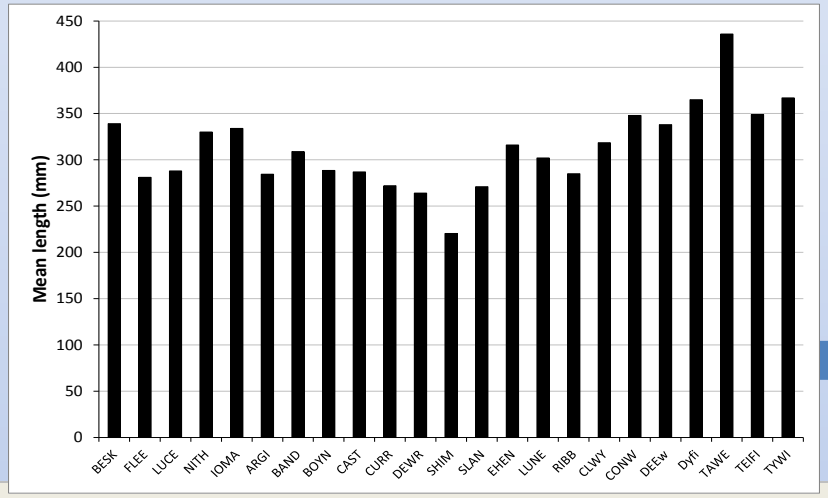
- Regional variation in life histories
- Feeding
- Movements and exchange

Variation in sea ages of sea trout

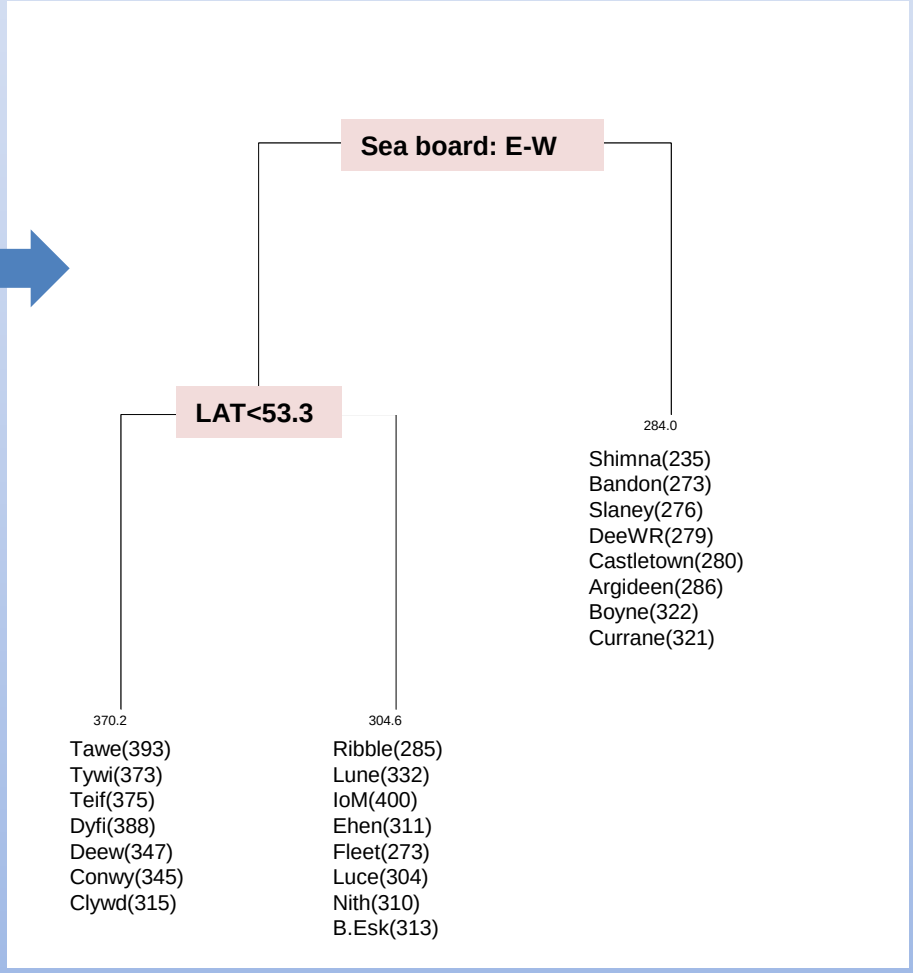
(from scale reading)



Spatial variation in marine growth, mean length(mm) at age n.0+

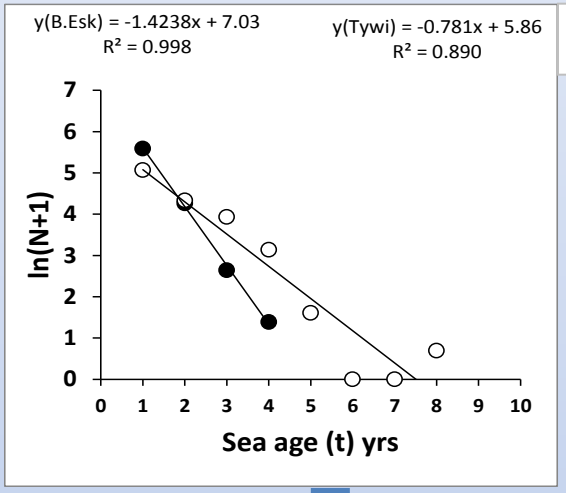


Between-river variation in length of n.0+ sea trout in 23 Irish Sea rivers

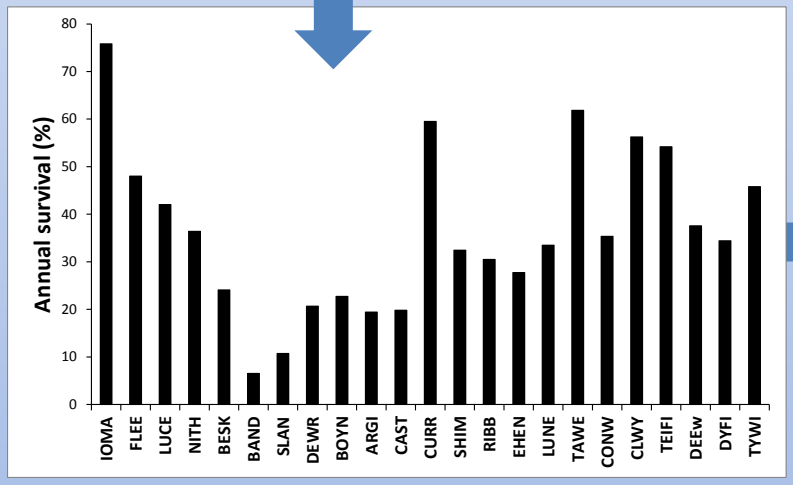


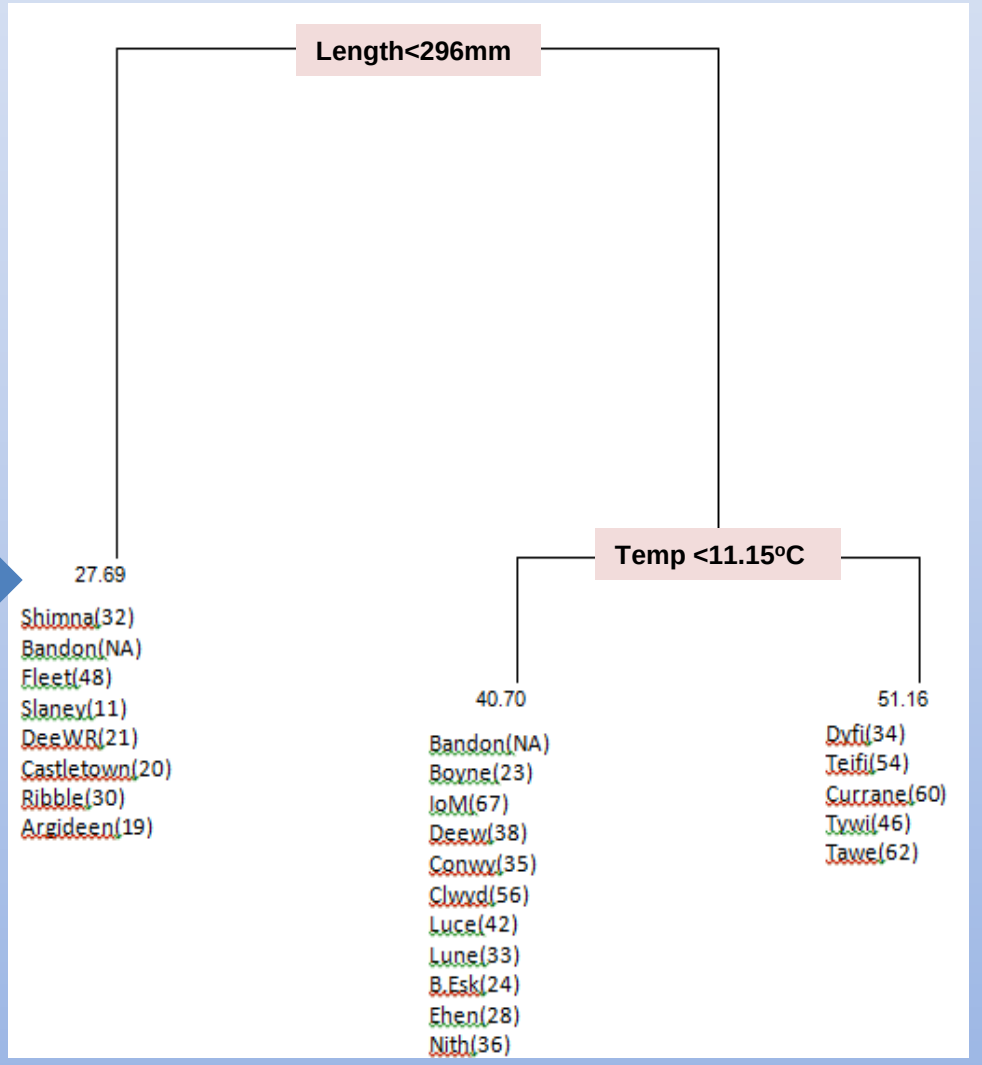
- Smaller on western sea board
- Latitude effect on east coast (larger in more southerly rivers)
- Caution, smolt length and age

Spatial variation in survival (%)



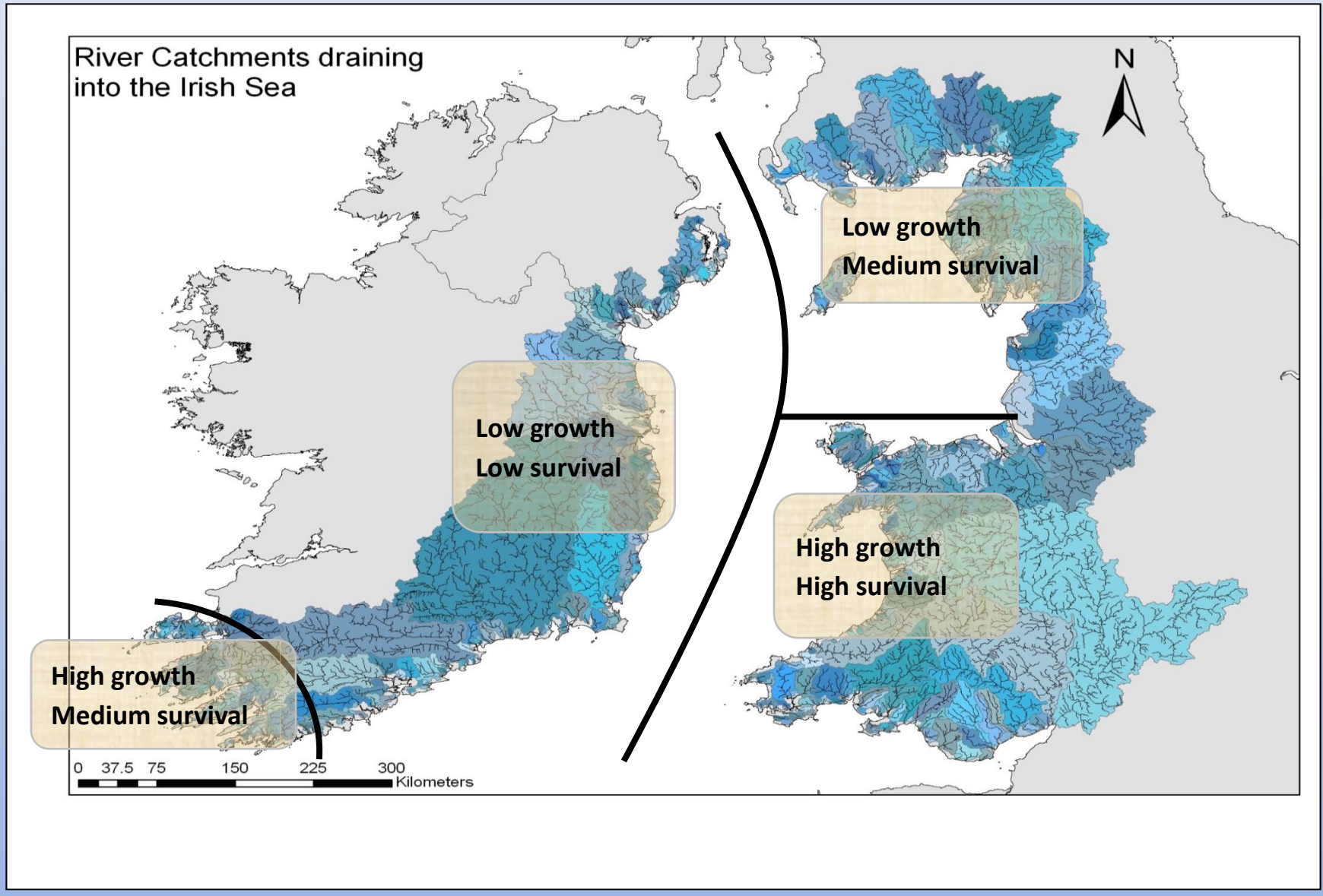
%S, after marine yr 1, from sea age structure (=$e^{(z+\ln 100)}$)



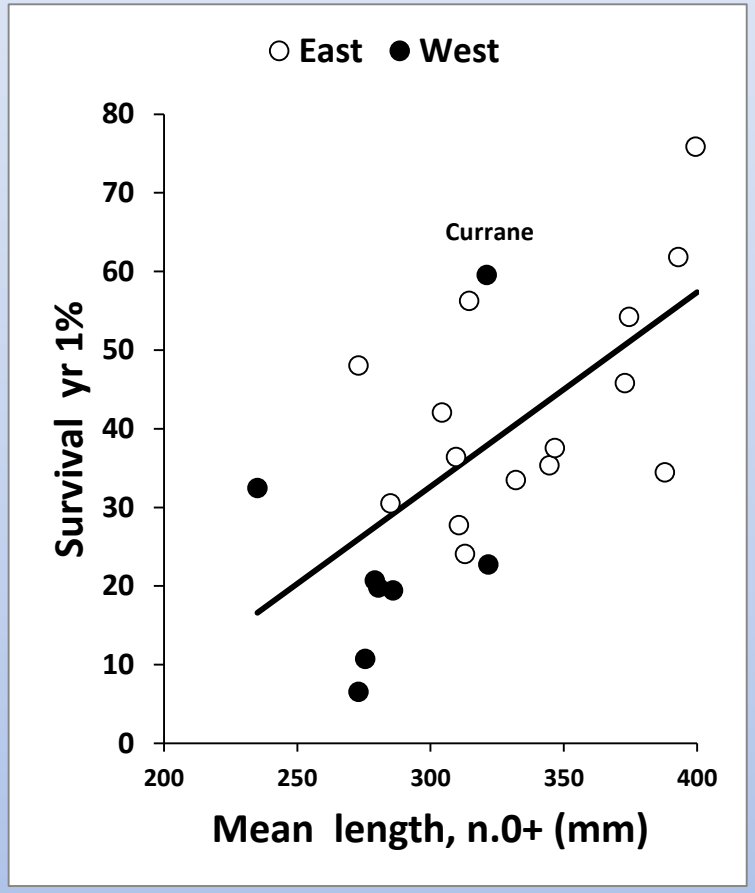


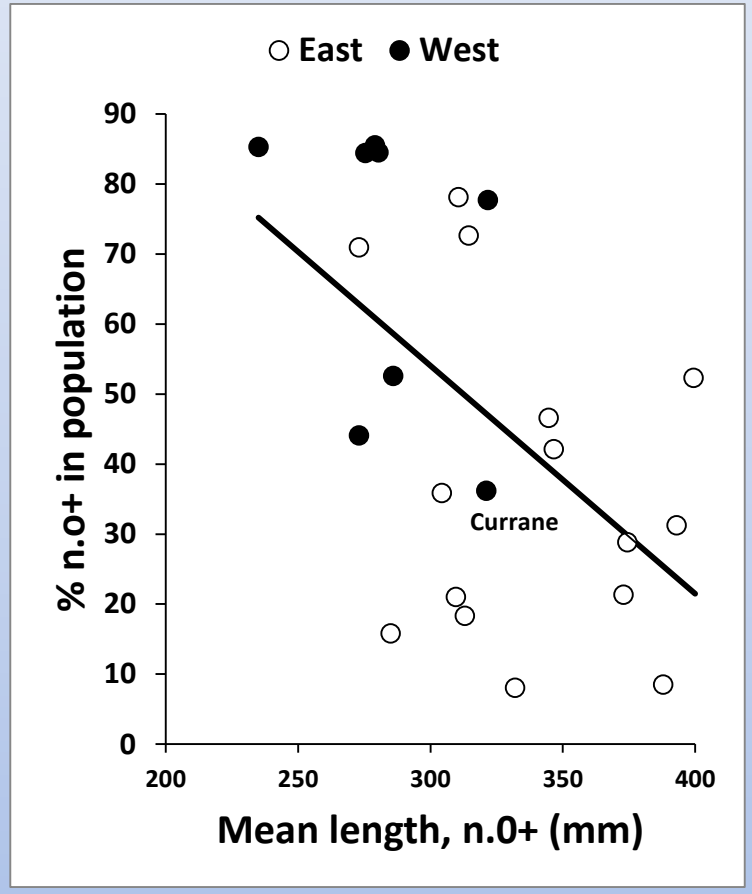
- Lower % S in popn of smaller size fish
- Lower % S in cooler waters (Irish coast & more northerly sites of eastern sea board)

Regional summary of growth and survival (selected by tree regression)



Life history responses to 1st year marine growth





- Marine survival (post 0+) increases with 2.0+ length (N=23 R^2=0.404,p<0.01)

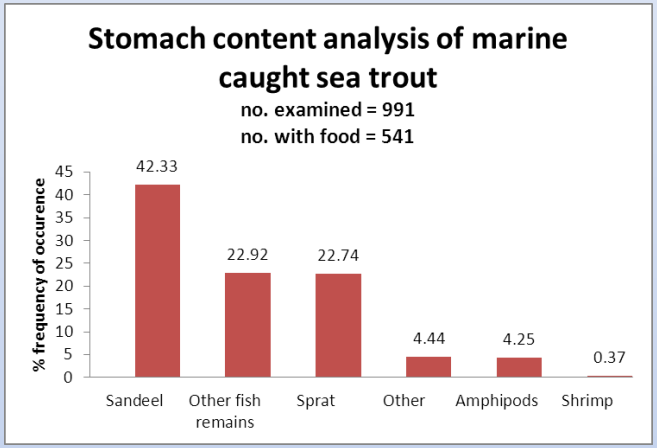
- Time of first return (as % 2.0+) decreases with 2.0+ length (N=23 R^2=0.288,p<0.01)

- Is earlier maturation a response to maximise reproductive opportunity in the face of marine environmental influence on growth and survival?

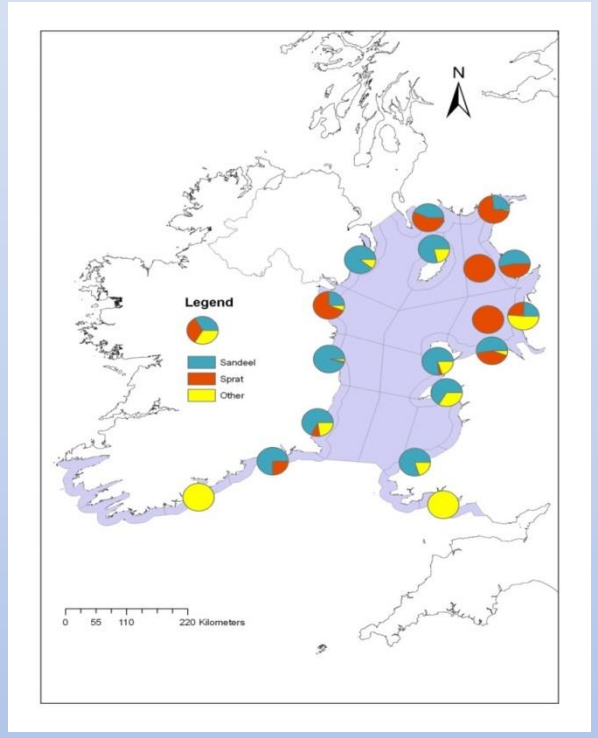
Results

- Trends in abundance and stock composition
- Regional variation in life histories
- **Feeding**
- Movements and exchange

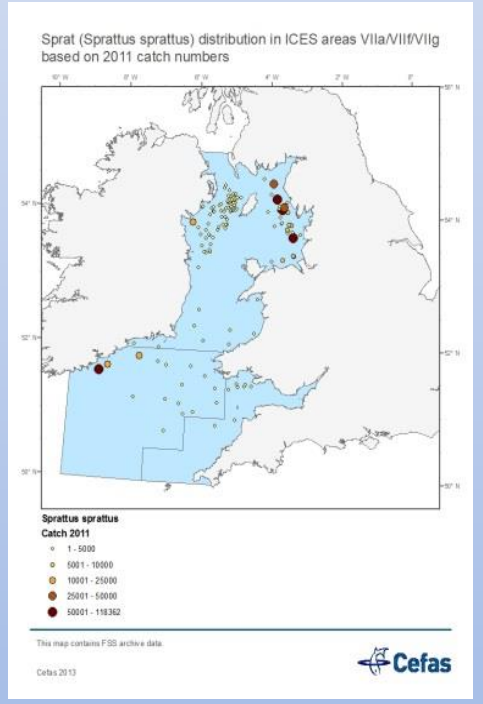
Adult sea trout prefer to eat fish



Regional variation



Prey (sprat) abundance



Results

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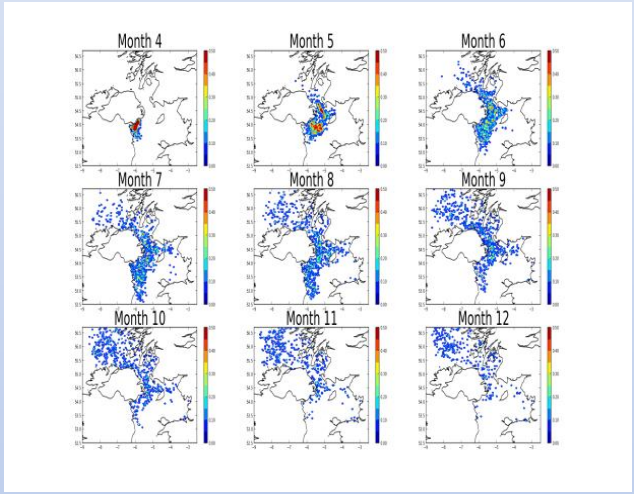
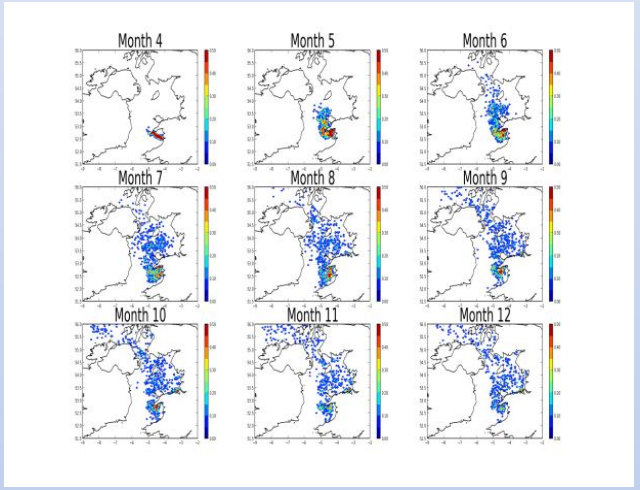
Hydrodynamic Modelling (Cefas)

General Estuarine Transport Model (GETM), simulates particle (=“fish”) movements, run from April 1st

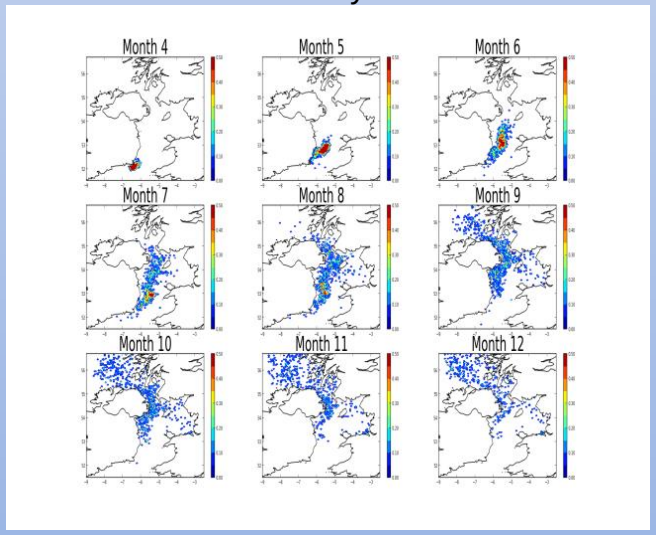
Shimna



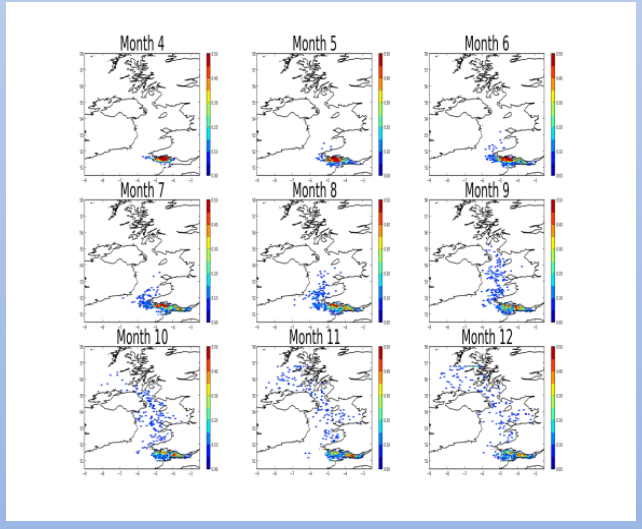
Dyfi



Slaney

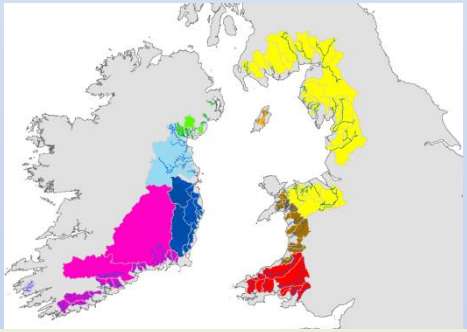


Tywi

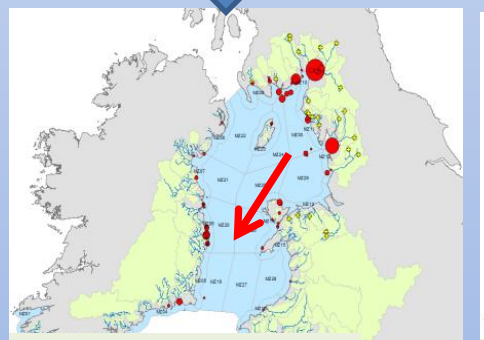


Genetic and microchemistry/radio isotope assignment of marine-caught fish to regions

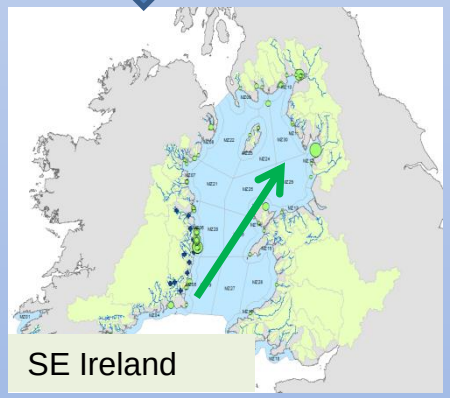
9 putative genetic regions identified by juvenile samples, 99 rivers



Marine samples assigned to regions by *Oncor/GeneClass consensus*

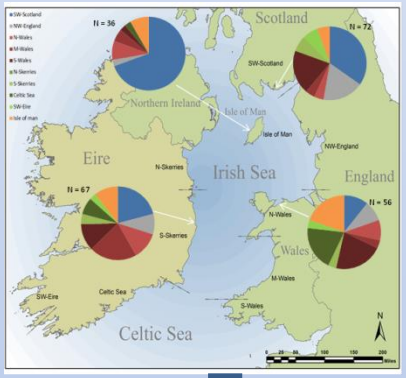


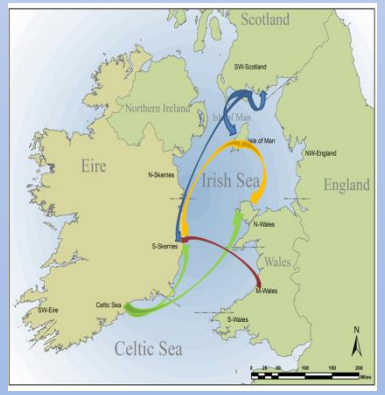
Solway/Morecombe



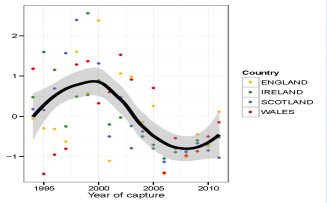
SE Ireland

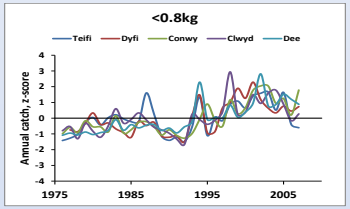
- Microchem origins based on 36 rivers
- δ15N suggested mainly coastal residency & some exchange



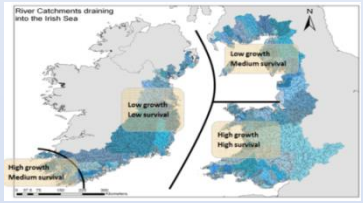


Overall: most fish remain “local”; evidence of some extensive exchange, can’t quantify due to small sample sizes





Conclusions



➢ LIFE HISTORIES and MARINE ECOLOGY

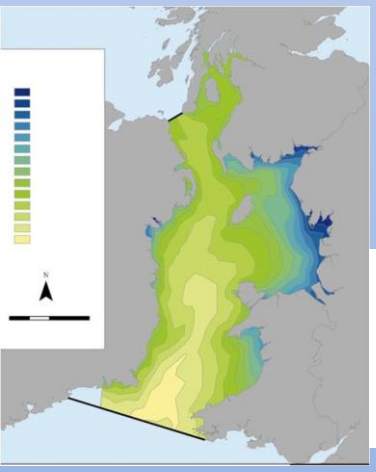
- Evidence of synchronous variation indicates response to common marine factor/s (can't yet rule out FW factors too)
- Stock structure variation reflects shifts in time of 1st return, likely due to growth and survival
- Regional growth variation linked to temperature (+ food?).....HABITAT
- Long term temporal growth variation cause remains uncertain (probably climate)
- Consistent with limited dispersal, reflecting marine hydro-graphic and environmental factors.
- BUT some extensive dispersal demonstrated by genetics, microchemistry and modelling

➢ MANAGEMENT & MONITORING

- Broad-scale conservation: does partial synchrony imply meta-population effects, conferring resilience and stability on individual rivers? (role of small streams?)
- Cross-border management of marine phase is indicated by the synchrony and partial dispersal
- Catch recording is weak and a major limitation: size data, fishing effort
- Marine food chain is important for sea trout, but key indicators are poorly monitored
- Marine habitat monitoring and protection are important for sea trout

Thanks to all the sponsors and many co-workers

… and many ‘00s of anglers



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